Derivation of Table 2 in Okada (1992)

[I] Derivation of Eqs.(4) through (6)

Eq.(1) of Okada (1992) can be rewritten $u^j = F\, g^j(x;\xi)$, where $g^j(x;\xi)$ is the displacement at x due to a j-th direction single force of unit magnitude located at ξ. When this is coupled in a k-th direction with moment $(j \neq k)$ or without moment $(j = k)$, double forces of opposite sign are arranged in the k-th direction with a separation of $\Delta\xi_k$, and $\Delta\xi_k \to 0$, $F \to \infty$ keeping $F\Delta\xi_k = M_0 = \text{const}$.

In this case, the displacement field due to such a force couple becomes as follows.

$$u^{j,k}(x;\xi) = \lim_{\Delta\xi_k \to 0} \frac{M_0}{\Delta\xi_k}\left[g^j(x;\xi_k + \Delta\xi_k) - g^j(x;\xi_k)\right] = M_0 \frac{\partial g^j}{\partial \xi_k} = \frac{M_0}{F}\frac{\partial u^j}{\partial \xi_k}$$

Eqs.(4) to (6) are written as the combination of these force couples.

Now, let us advance to practical cases. The displacement field due to a general dislocation source is given by eq.(3), i.e. famous Steketee's formula. This formula is composed from the combination of force couples.
If we adopt the geometry as in Fig.2 of Okada (1992), the displacement fields due to elementary dislocation sources can be calculated by substitution of the following vectors into eq.(3).

$$\Delta u_j = \begin{cases} (U, 0, 0) & \text{for a strike} - \text{slip} \\ (0, U\cos\delta, U\sin\delta) & \text{for a dip} - \text{slip} \\ (0, -U\sin\delta, U\cos\delta) & \text{for a tensile} \end{cases} \quad \text{and} \quad \nu_k = (0, -\sin\delta, \cos\delta)$$

(a) Strike-slip

$$\begin{aligned} u &= \frac{\mu U}{F}\iint\left[\left(\frac{\partial u^1}{\partial \xi_2} + \frac{\partial u^2}{\partial \xi_1}\right)\nu_2 + \left(\frac{\partial u^1}{\partial \xi_3} + \frac{\partial u^3}{\partial \xi_1}\right)\nu_3\right] d\Sigma \\ &= \frac{\mu U}{F}\iint\left[-\left(\frac{\partial u^1}{\partial \xi_2} + \frac{\partial u^2}{\partial \xi_1}\right)\sin\delta + \left(\frac{\partial u^1}{\partial \xi_3} + \frac{\partial u^3}{\partial \xi_1}\right)\cos\delta\right] d\Sigma \end{aligned}$$

(b) Dip-slip

$$\begin{aligned} u &= \frac{U\cos\delta}{F}\iint\left[\left(\lambda\frac{\partial u^n}{\partial \xi_n} + 2\mu\frac{\partial u^2}{\partial \xi_2}\right)\nu_2 + \mu\left(\frac{\partial u^2}{\partial \xi_3} + \frac{\partial u^3}{\partial \xi_2}\right)\nu_3\right] d\Sigma \\ &+ \frac{U\sin\delta}{F}\iint\left[\mu\left(\frac{\partial u^3}{\partial \xi_2} + \frac{\partial u^2}{\partial \xi_3}\right)\nu_2 + \left(\lambda\frac{\partial u^n}{\partial \xi_n} + 2\mu\frac{\partial u^3}{\partial \xi_3}\right)\nu_3\right] d\Sigma \\ &= \frac{\mu U}{F}\iint\left[\left(\frac{\partial u^2}{\partial \xi_3} + \frac{\partial u^3}{\partial \xi_2}\right)\cos 2\delta + \left(\frac{\partial u^3}{\partial \xi_3} - \frac{\partial u^2}{\partial \xi_2}\right)\sin 2\delta\right] d\Sigma \end{aligned}$$

(c) Tensile

$$\begin{aligned} u &= -\frac{U\sin\delta}{F}\iint\left[\left(\lambda\frac{\partial u^n}{\partial \xi_n} + 2\mu\frac{\partial u^2}{\partial \xi_2}\right)\nu_2 + \mu\left(\frac{\partial u^2}{\partial \xi_3} + \frac{\partial u^3}{\partial \xi_2}\right)\nu_3\right] d\Sigma \\ &+ \frac{U\cos\delta}{F}\iint\left[\mu\left(\frac{\partial u^3}{\partial \xi_2} + \frac{\partial u^2}{\partial \xi_3}\right)\nu_2 + \left(\lambda\frac{\partial u^n}{\partial \xi_n} + 2\mu\frac{\partial u^3}{\partial \xi_3}\right)\nu_3\right] d\Sigma \\ &= \frac{\mu U}{F}\iint\left[\frac{\lambda}{\mu}\frac{\partial u^n}{\partial \xi_n} + 2\left(\frac{\partial u^2}{\partial \xi_2}\sin^2\delta + \frac{\partial u^3}{\partial \xi_3}\cos^2\delta\right) - \left(\frac{\partial u^2}{\partial \xi_3} + \frac{\partial u^3}{\partial \xi_2}\right)\sin 2\delta\right] d\Sigma \end{aligned}$$

If we define $\alpha = \frac{\lambda+\mu}{\lambda+2\mu}$, we can write $\frac{\lambda}{\mu} = \frac{2\alpha-1}{1-\alpha}$

Here, let us remind the body force equivalents for the dislocation sources. In case of a shear fault, the dislocation U on the fault of area S corresponds to a double couple with a moment of $M_0 = \mu US$ (nuclei-B), while the dislocation U on a tensile fault of area S corresponds to a combination of a center of dilatation of intensity λUS and a couple without moment of intensity $2\mu US$ (nuclei-A).

For a point source, replacing $\mu U \iint[\cdots\cdots]d\Sigma$ to M_0, we can get Eqs.(4) to (6) in the following form.

$$u^0(x, y, z) = \frac{M_0}{F}\iint[\cdots\cdots]\, d\Sigma$$

As to the concept of body force equivalents, refer to the following papers.

Steketee, J. A. (1958) Some geophysical applications of the elasticity theory of dislocation, *Can. J. Phys.*, **36**, 1168-1198.
Maruyama, T. (1963) On the force equivalents of dynamical elastic dislocations with reference to the earthquake mechanism, *Bull. Earthq. Res. Inst., Univ. Tokyo*, **41**, 467-486.
Burridge, R., and L. Knopoff (1964) Body force equivalents for seismic dislocations, *Bull. Seism. Soc. Am.*, **54**, 1875-1888.

[II] Derivation of Table 2

(1) Strike slip   << Substitution of eq. (2) to eq. (4) >>

Elements of displacement at (x_1, x_2, x_3) due to strain nuclei $\partial u^1/\partial\xi_2$ at (ξ_1, ξ_2, ξ_3) are as follows.

$$\frac{\partial u^1_{i\,A}}{\partial\xi_2} = \frac{F}{8\pi\mu}\left\{(2-\alpha)\frac{R_2}{R^3}\delta_{i1} - \alpha\frac{R_1}{R^3}\delta_{i2} + 3\alpha\frac{R_1R_2R_i}{R^5}\right\}$$

$$\frac{\partial u^1_{i\,B}}{\partial\xi_2} = \frac{F}{4\pi\mu}\left\{\frac{R_2\delta_{i1} - R_1\delta_{i2}}{R^3} + \frac{3R_1R_2R_i}{R^5} + \frac{1-\alpha}{\alpha}\left[\frac{R_2\delta_{i1}}{R(R+R_3)^2} - \frac{R_1R_2(2R+R_3)}{R^3(R+R_3)^2}\delta_{i3} + \left(\frac{R_1\delta_{i2}}{R(R+R_3)^2} - \frac{R_1R_2R_i(3R+R_3)}{R^3(R+R_3)^3}\right)(1-\delta_{i3})\right]\right\}$$

$$\frac{\partial u^1_{i\,C}}{\partial\xi_2} = \frac{F}{4\pi\mu}(1-2\delta_{i3})\left\{-(2-\alpha)\frac{3R_1R_2}{R^5}\delta_{i3} + 3\alpha\xi_3\left(\frac{R_2\delta_{i1} + R_1\delta_{i2}}{R^5} - \frac{5R_1R_2R_i}{R^7}\right)\right\}$$

Elements of displacement at (x_1, x_2, x_3) due to strain nuclei $\partial u^2/\partial\xi_1$ at (ξ_1, ξ_2, ξ_3) are as follows.

$$\frac{\partial u^2_{i\,A}}{\partial\xi_1} = \frac{F}{8\pi\mu}\left\{(2-\alpha)\frac{R_1}{R^3}\delta_{i2} - \alpha\frac{R_2}{R^3}\delta_{i1} + 3\alpha\frac{R_1R_2R_i}{R^5}\right\}$$

$$\frac{\partial u^2_{i\,B}}{\partial\xi_1} = \frac{F}{4\pi\mu}\left\{\frac{R_1\delta_{i2} - R_2\delta_{i1}}{R^3} + \frac{3R_1R_2R_i}{R^5} + \frac{1-\alpha}{\alpha}\left[\frac{R_1\delta_{i2}}{R(R+R_3)^2} - \frac{R_1R_2(2R+R_3)}{R^3(R+R_3)^2}\delta_{i3} + \left(\frac{R_2\delta_{i1}}{R(R+R_3)^2} - \frac{R_1R_2R_i(3R+R_3)}{R^3(R+R_3)^3}\right)(1-\delta_{i3})\right]\right\}$$

$$\frac{\partial u^2_{i\,C}}{\partial\xi_1} = \frac{F}{4\pi\mu}(1-2\delta_{i3})\left\{-(2-\alpha)\frac{3R_1R_2}{R^5}\delta_{i3} + 3\alpha\xi_3\left(\frac{R_2\delta_{i1} + R_1\delta_{i2}}{R^5} - \frac{5R_1R_2R_i}{R^7}\right)\right\}$$

Elements of displacement at (x_1, x_2, x_3) due to strain nuclei $\partial u^1/\partial\xi_3$ at (ξ_1, ξ_2, ξ_3) are as follows.

$$\frac{\partial u^1_{i\,A}}{\partial\xi_3} = \frac{F}{8\pi\mu}\left\{(2-\alpha)\frac{R_3}{R^3}\delta_{i1} - \alpha\frac{R_1}{R^3}\delta_{i3} + 3\alpha\frac{R_1R_3R_i}{R^5}\right\}$$

$$\frac{\partial u^1_{i\,B}}{\partial\xi_3} = \frac{F}{4\pi\mu}\left\{\frac{R_3\delta_{i1} - R_1\delta_{i3}}{R^3} + \frac{3R_1R_3R_i}{R^5} + \frac{1-\alpha}{\alpha}\left[\frac{\delta_{i1}}{R(R+R_3)} - \frac{R_1}{R^3}\delta_{i3} - \frac{R_1R_i(2R+R_3)}{R^3(R+R_3)^2}(1-\delta_{i3})\right]\right\}$$

$$\frac{\partial u^1_{i\,C}}{\partial\xi_3} = \frac{F}{4\pi\mu}(1-2\delta_{i3})\left\{-(2-\alpha)\frac{3R_1R_3}{R^5}\delta_{i3} + \alpha\left(\frac{\delta_{i1}}{R^3} - \frac{3R_1R_i}{R^5}\right) + 3\alpha\xi_3\left(\frac{R_3\delta_{i1} + R_1\delta_{i3}}{R^5} - \frac{5R_1R_3R_i}{R^7}\right)\right\}$$

Elements of displacement at (x_1, x_2, x_3) due to strain nuclei $\partial u^3/\partial\xi_1$ at (ξ_1, ξ_2, ξ_3) are as follows.

$$\frac{\partial u^3_{i\,A}}{\partial\xi_1} = \frac{F}{8\pi\mu}\left\{(2-\alpha)\frac{R_1}{R^3}\delta_{i3} - \alpha\frac{R_3}{R^3}\delta_{i1} + 3\alpha\frac{R_1R_3R_i}{R^5}\right\}$$

$$\frac{\partial u^3_{i\,B}}{\partial\xi_1} = \frac{F}{4\pi\mu}\left\{\frac{R_1\delta_{i3} - R_3\delta_{i1}}{R^3} + \frac{3R_1R_3R_i}{R^5} + \frac{1-\alpha}{\alpha}\left[\frac{R_1\delta_{i3}}{R(R+R_3)^2} - \frac{\delta_{i1}}{R(R+R_3)} + \frac{R_1R_i(2R+R_3)}{R^3(R+R_3)^2}\right]\right\}$$

$$\frac{\partial u^3_{i\,C}}{\partial\xi_1} = \frac{F}{4\pi\mu}(1-2\delta_{i3})\left\{(2-\alpha)\left(-\frac{\delta_{i1}}{R^3} + \frac{3R_1(R_i - R_3\delta_{i3})}{R^5}\right) + 3\alpha\xi_3\left(\frac{R_3\delta_{i1} + R_1\delta_{i3}}{R^5} - \frac{5R_1R_3R_i}{R^7}\right)\right\}$$

where, $R_1 = x_1 - \xi_1,\ R_2 = x_2 - \xi_2,\ R_3 = -x_3 - \xi_3$ and $R^2 = R_1^2 + R_2^2 + R_3^2$

When source is located at $(0, 0, -c)$, $\xi_1 = 0,\ \xi_2 = 0,\ \xi_3 = -c$

So, $R_1 = x_1,\ R_2 = x_2,\ R_3 = c - x_3$

Here, if we use coordinate system (x, y, z) instead of (x_1, x_2, x_3), $R_1 = x,\ R_2 = y,\ R_3 = c - z = d$

Then, the above displacement elements are written as follows

Elements of displacement at (x, y, z) due to strain nuclei $\partial u^1/\partial \xi_2$ at $(0, 0, -c)$ are

$$\frac{\partial u^1_{i\,A}}{\partial \xi_2} = \frac{F}{8\pi\mu}\left\{(2-\alpha)\frac{y}{R^3}\delta_{i1} - \alpha\frac{x}{R^3}\delta_{i2} + \alpha\frac{3xyR_i}{R^5}\right\}$$

$$\frac{\partial u^1_{i\,B}}{\partial \xi_2} = \frac{F}{4\pi\mu}\left\{\frac{y\delta_{i1} - x\delta_{i2}}{R^3} + \frac{3xyR_i}{R^5} + \frac{1-\alpha}{\alpha}\left[\frac{y\delta_{i1}}{R(R+d)^2} - \frac{xy(2R+d)}{R^3(R+d)^2}\delta_{i3} + \left(\frac{x\delta_{i2}}{R(R+d)^2} - \frac{xyR_i(3R+d)}{R^3(R+d)^3}\right)(1-\delta_{i3})\right]\right\}$$

$$\frac{\partial u^1_{i\,C}}{\partial \xi_2} = \frac{F}{4\pi\mu}(1-2\delta_{i3})\left\{-(2-\alpha)\frac{3xy}{R^5}\delta_{i3} - 3c\alpha\left(\frac{y\delta_{i1} + x\delta_{i2}}{R^5} - \frac{5xyR_i}{R^7}\right)\right\}$$

Elements of displacement at (x, y, z) due to strain nuclei $\partial u^2/\partial \xi_1$ at $(0, 0, -c)$ are

$$\frac{\partial u^2_{i\,A}}{\partial \xi_1} = \frac{F}{8\pi\mu}\left\{(2-\alpha)\frac{x}{R^3}\delta_{i2} - \alpha\frac{y}{R^3}\delta_{i1} + \alpha\frac{3xyR_i}{R^5}\right\}$$

$$\frac{\partial u^2_{i\,B}}{\partial \xi_1} = \frac{F}{4\pi\mu}\left\{\frac{x\delta_{i2} - y\delta_{i1}}{R^3} + \frac{3xyR_i}{R^5} + \frac{1-\alpha}{\alpha}\left[\frac{x\delta_{i2}}{R(R+d)^2} - \frac{xy(2R+d)}{R^3(R+d)^2}\delta_{i3} + \left(\frac{y\delta_{i1}}{R(R+d)^2} - \frac{xyR_i(3R+d)}{R^3(R+d)^3}\right)(1-\delta_{i3})\right]\right\}$$

$$\frac{\partial u^2_{i\,C}}{\partial \xi_1} = \frac{F}{4\pi\mu}(1-2\delta_{i3})\left\{-(2-\alpha)\frac{3xy}{R^5}\delta_{i3} - 3c\alpha\left(\frac{y\delta_{i1} + x\delta_{i2}}{R^5} - \frac{5xyR_i}{R^7}\right)\right\}$$

Elements of displacement at (x, y, z) due to strain nuclei $\partial u^1/\partial \xi_3$ at $(0, 0, -c)$ are

$$\frac{\partial u^1_{i\,A}}{\partial \xi_3} = \frac{F}{8\pi\mu}\left\{(2-\alpha)\frac{d}{R^3}\delta_{i1} - \alpha\frac{x}{R^3}\delta_{i3} + \alpha\frac{3xdR_i}{R^5}\right\}$$

$$\frac{\partial u^1_{i\,B}}{\partial \xi_3} = \frac{F}{4\pi\mu}\left\{\frac{d\delta_{i1} - x\delta_{i3}}{R^3} + \frac{3xdR_i}{R^5} + \frac{1-\alpha}{\alpha}\left[\frac{\delta_{i1}}{R(R+d)} - \frac{x}{R^3}\delta_{i3} - \frac{xR_i(2R+d)}{R^3(R+d)^2}(1-\delta_{i3})\right]\right\}$$

$$\frac{\partial u^1_{i\,C}}{\partial \xi_3} = \frac{F}{4\pi\mu}(1-2\delta_{i3})\left\{-(2-\alpha)\frac{3xd}{R^5}\delta_{i3} + \alpha\left(\frac{\delta_{i1}}{R^3} - \frac{3xR_i}{R^5}\right) - 3c\alpha\left(\frac{d\delta_{i1} + x\delta_{i3}}{R^5} - \frac{5xdR_i}{R^7}\right)\right\}$$

Elements of displacement at (x, y, z) due to strain nuclei $\partial u^3/\partial \xi_1$ at $(0, 0, -c)$ are

$$\frac{\partial u^3_{i\,A}}{\partial \xi_1} = \frac{F}{8\pi\mu}\left\{(2-\alpha)\frac{x}{R^3}\delta_{i3} - \alpha\frac{d}{R^3}\delta_{i1} + \alpha\frac{3xdR_i}{R^5}\right\}$$

$$\frac{\partial u^3_{i\,B}}{\partial \xi_1} = \frac{F}{4\pi\mu}\left\{\frac{x\delta_{i3} - d\delta_{i1}}{R^3} + \frac{3xdR_i}{R^5} + \frac{1-\alpha}{\alpha}\left[\frac{x\delta_{i3}}{R(R+d)^2} - \frac{\delta_{i1}}{R(R+d)} + \frac{xR_i(2R+d)}{R^3(R+d)^2}\right]\right\}$$

$$\frac{\partial u^3_{i\,C}}{\partial \xi_1} = \frac{F}{4\pi\mu}(1-2\delta_{i3})\left\{(2-\alpha)\left(-\frac{\delta_{i1}}{R^3} + \frac{3x(R_i - d\delta_{i3})}{R^5}\right) - 3c\alpha\left(\frac{d\delta_{i1} + x\delta_{i3}}{R^5} - \frac{5xdR_i}{R^7}\right)\right\}$$

Combining these components,

$$u^{12+21}_{i\ \ A} \equiv \frac{\partial u^1_{i\,A}}{\partial \xi_2} + \frac{\partial u^2_{i\,A}}{\partial \xi_1} = \frac{F}{4\pi\mu}\left\{(1-\alpha)\frac{y\delta_{i1} + x\delta_{i2}}{R^3} + \alpha\frac{3xyR_i}{R^5}\right\}$$

$$u^{12+21}_{i\ \ B} \equiv \frac{\partial u^1_{i\,B}}{\partial \xi_2} + \frac{\partial u^2_{i\,B}}{\partial \xi_1} = \frac{F}{2\pi\mu}\left\{\frac{3xyR_i}{R^5} + \frac{1-\alpha}{\alpha}\left[\frac{y\delta_{i1} + x\delta_{i2}}{R(R+d)^2} - \frac{xy(2R+d)}{R^3(R+d)^2}\delta_{i3} - \frac{xyR_i(3R+d)}{R^3(R+d)^3}(1-\delta_{i3})\right]\right\}$$

$$u^{12+21}_{i\ \ C} \equiv \frac{\partial u^1_{i\,C}}{\partial \xi_2} + \frac{\partial u^2_{i\,C}}{\partial \xi_1} = \frac{F}{2\pi\mu}(1-2\delta_{i3})\left\{-(2-\alpha)\frac{3xy}{R^5}\delta_{i3} - 3c\alpha\left(\frac{y\delta_{i1} + x\delta_{i2}}{R^5} - \frac{5xyR_i}{R^7}\right)\right\}$$

$$u^{13+31}_{i\ \ A} \equiv \frac{\partial u^1_{i\,A}}{\partial \xi_3} + \frac{\partial u^3_{i\,A}}{\partial \xi_1} = \frac{F}{4\pi\mu}\left\{(1-\alpha)\frac{d\delta_{i1} + x\delta_{i3}}{R^3} + \alpha\frac{3xdR_i}{R^5}\right\}$$

$$u^{13+31}_{i\ \ B} \equiv \frac{\partial u^1_{i\,B}}{\partial \xi_3} + \frac{\partial u^3_{i\,B}}{\partial \xi_1} = \frac{F}{2\pi\mu}\left\{\frac{3xdR_i}{R^5} + \frac{1-\alpha}{2\alpha}x(R_i - d)\frac{2R+d}{R^3(R+d)^2}\delta_{i3}\right\}$$

$$u^{13+31}_{i\ \ C} \equiv \frac{\partial u^1_{i\,C}}{\partial \xi_3} + \frac{\partial u^3_{i\,C}}{\partial \xi_1} = \frac{F}{2\pi\mu}(1-2\delta_{i3})\left\{(1-\alpha)\left(-\frac{\delta_{i1}}{R^3} + \frac{3xR_i}{R^5}\right) - (2-\alpha)\frac{3xd}{R^5}\delta_{i3} - 3c\alpha\left(\frac{d\delta_{i1} + x\delta_{i3}}{R^5} - \frac{5xdR_i}{R^7}\right)\right\}$$

Namely, the elements of displacement at (x, y, z) due to a double couple (12+21) at $(0, 0, -c)$ are as follows.

$$u_i^{12+21}{}_A = \frac{F}{2\pi\mu}\begin{pmatrix} \frac{1-\alpha}{2}\frac{y}{R^3} + \frac{\alpha}{2}\frac{3x^2y}{R^5} \\ \frac{1-\alpha}{2}\frac{x}{R^3} + \frac{\alpha}{2}\frac{3xy^2}{R^5} \\ \frac{\alpha}{2}\frac{3xyd}{R^5} \end{pmatrix} \quad u_i^{12+21}{}_B = \frac{F}{2\pi\mu}\begin{pmatrix} \frac{3x^2y}{R^5} + \frac{1-\alpha}{\alpha}I_1^0 \\ \frac{3xy^2}{R^5} + \frac{1-\alpha}{\alpha}I_2^0 \\ \frac{3xyd}{R^5} + \frac{1-\alpha}{\alpha}I_4^0 \end{pmatrix} \quad u_i^{12+21}{}_C = \frac{F}{2\pi\mu}\begin{pmatrix} -\alpha\frac{3cy}{R^5}A_5 \\ -\alpha\frac{3cx}{R^5}B_5 \\ (2-\alpha)\frac{3xy}{R^5} - \alpha\frac{3cx}{R^5}\frac{5yd}{R^2} \end{pmatrix}$$

And the elements of displacement at (x, y, z) due to a double couple (13+31) at $(0, 0, -c)$ are as follows.

$$u_i^{13+31}{}_A = \frac{F}{2\pi\mu}\begin{pmatrix} \frac{1-\alpha}{2}\frac{d}{R^3} + \frac{\alpha}{2}\frac{3x^2d}{R^5} \\ \frac{\alpha}{2}\frac{3xyd}{R^5} \\ \frac{1-\alpha}{2}\frac{x}{R^3} + \frac{\alpha}{2}\frac{3xd^2}{R^5} \end{pmatrix} \quad u_i^{13+31}{}_B = \frac{F}{2\pi\mu}\begin{pmatrix} \frac{3x^2d}{R^5} \\ \frac{3xyd}{R^5} \\ \frac{3xd^2}{R^5} \end{pmatrix} \quad u_i^{13+31}{}_C = \frac{F}{2\pi\mu}\begin{pmatrix} -(1-\alpha)\frac{1}{R^3}A_3 - \alpha\frac{3cd}{R^5}A_5 \\ (1-\alpha)\frac{3xy}{R^5} + \alpha\frac{3cx}{R^5}\frac{5yd}{R^2} \\ \frac{3xd}{R^5} + \alpha\frac{3cx}{R^5}C_5 \end{pmatrix}$$

where, $A_3 = 1 - \frac{3x^2}{R^2}$, $A_5 = 1 - \frac{5x^2}{R^2}$, $B_5 = 1 - \frac{5y^2}{R^2}$, $C_5 = 1 - \frac{5d^2}{R^2}$ and

$$I_1^0 = y\left[\frac{1}{R(R+d)^2} - x^2\frac{3R+d}{R^3(R+d)^3}\right] \quad I_2^0 = x\left[\frac{1}{R(R+d)^2} - y^2\frac{3R+d}{R^3(R+d)^3}\right] \quad I_4^0 = -xy\frac{2R+d}{R^3(R+d)^2}$$

Finally the displacement due to a point strike-slip with a moment *Mo* are given by eq.(4).

$$u^o = \frac{Mo}{F}\left[-u^{12+21}\sin\delta + u^{13+31}\cos\delta\right]$$

So, their elements of displacement at (x, y, z) due to a point strike-slip at $(0, 0, -c)$ are as follows.

$$u_A^o = \frac{Mo}{2\pi\mu}\begin{pmatrix} -\frac{1-\alpha}{2}\frac{q}{R^3} - \frac{\alpha}{2}\frac{3x^2q}{R^5} \\ -\frac{1-\alpha}{2}\frac{x}{R^3}\sin\delta - \frac{\alpha}{2}\frac{3xyq}{R^5} \\ \frac{1-\alpha}{2}\frac{x}{R^3}\cos\delta - \frac{\alpha}{2}\frac{3xdq}{R^5} \end{pmatrix} \quad u_B^o = \frac{Mo}{2\pi\mu}\begin{pmatrix} -\frac{3x^2q}{R^5} - \frac{1-\alpha}{\alpha}I_1^0\sin\delta \\ -\frac{3xyq}{R^5} - \frac{1-\alpha}{\alpha}I_2^0\sin\delta \\ -\frac{3xdq}{R^5} - \frac{1-\alpha}{\alpha}I_4^0\sin\delta \end{pmatrix}$$

$$u_C^o = \frac{Mo}{2\pi\mu}\begin{pmatrix} -(1-\alpha)\frac{1}{R^3}A_3\cos\delta + \alpha\frac{3cq}{R^5}A_5 \\ (1-\alpha)\frac{3xy}{R^5}\cos\delta + \alpha\frac{3cx}{R^5}\left(\sin\delta - \frac{5yq}{R^2}\right) \\ -(1-\alpha)\frac{3xy}{R^5}\sin\delta + \alpha\frac{3cx}{R^5}\left(\cos\delta + \frac{5dq}{R^2}\right) - \frac{3xq}{R^5} \end{pmatrix}$$

where, $d = c - z$, $q = y\sin\delta - d\cos\delta$, $R^2 = x^2 + y^2 + d^2$

The above three vectors basically correspond to the contents of the row of Strike Slip in Table 2, although a slight modification was made in the following two points.

(1) The sign of u_A^o was converted, because this part is calculated by $u_A^o(x, y, z) - u_A^o(x, y, -z)$, different from its original definition in eq.(2), $u_A(x_1, x_2, -x_3) - u_A(x_1, x_2, x_3)$.

(2) Terms of *z*-components in u_B^o $\left(-\frac{3xdq}{R^5}\right)$ and u_C^o $\left(-\frac{3xq}{R^5}\right)$ were partially merged using the calculation rule of $u_B^o(x, y, z) + zu_C^o(x, y, z)$ to get the simpler expression.

Since $-\frac{3xdq}{R^5} - z\frac{3xq}{R^5} = -\frac{3cxq}{R^5}$, $3xdq$ was changed to $3cxq$ in the *z*-component of u_B^o, while the term $-\frac{3xq}{R^5}$ disappeared from the *z*-component of u_C^o.

(2) Dip slip << Substitution of eq. (2) to eq. (5) >>

Elements of displacement at (x_1, x_2, x_3) due to strain nuclei $\partial u^2/\partial \xi_3$ at (ξ_1, ξ_2, ξ_3) are as follows.

$$\frac{\partial u_{i\,A}^2}{\partial \xi_3} = \frac{F}{8\pi\mu}\left\{(2-\alpha)\frac{R_3}{R^3}\delta_{i2} - \alpha\frac{R_2}{R^3}\delta_{i3} + 3\alpha\frac{R_2R_3R_i}{R^5}\right\}$$

$$\frac{\partial u_{i\,B}^2}{\partial \xi_3} = \frac{F}{4\pi\mu}\left\{\frac{R_3\delta_{i2} - R_2\delta_{i3}}{R^3} + \frac{3R_2R_3R_i}{R^5} + \frac{1-\alpha}{\alpha}\left[\frac{\delta_{i2}}{R(R+R_3)} - \frac{R_2}{R^3}\delta_{i3} - \frac{R_2R_i(2R+R_3)}{R^3(R+R_3)^2}(1-\delta_{i3})\right]\right\}$$

$$\frac{\partial u_{i\,C}^2}{\partial \xi_3} = \frac{F}{4\pi\mu}(1-2\delta_{i3})\left\{-(2-\alpha)\frac{3R_2R_3}{R^5}\delta_{i3} + \alpha\left(\frac{\delta_{i2}}{R^3} - \frac{3R_2R_i}{R^5}\right) + 3\alpha\xi_3\left(\frac{R_3\delta_{i2} + R_2\delta_{i3}}{R^5} - \frac{5R_2R_3R_i}{R^7}\right)\right\}$$

Elements of displacement at (x_1, x_2, x_3) due to strain nuclei $\partial u^3/\partial \xi_2$ at (ξ_1, ξ_2, ξ_3) are as follows.

$$\frac{\partial u_{i\,A}^3}{\partial \xi_2} = \frac{F}{8\pi\mu}\left\{(2-\alpha)\frac{R_2}{R^3}\delta_{i3} - \alpha\frac{R_3}{R^3}\delta_{i2} + 3\alpha\frac{R_2R_3R_i}{R^5}\right\}$$

$$\frac{\partial u_{i\,B}^3}{\partial \xi_2} = \frac{F}{4\pi\mu}\left\{\frac{R_2\delta_{i3} - R_3\delta_{i2}}{R^3} + \frac{3R_2R_3R_i}{R^5} + \frac{1-\alpha}{\alpha}\left[\frac{R_2\delta_{i3}}{R(R+R_3)^2} - \frac{\delta_{i2}}{R(R+R_3)} + \frac{R_2R_i(2R+R_3)}{R^3(R+R_3)^2}\right]\right\}$$

$$\frac{\partial u_{i\,C}^3}{\partial \xi_2} = \frac{F}{4\pi\mu}(1-2\delta_{i3})\left\{(2-\alpha)\left(-\frac{\delta_{i2}}{R^3} + \frac{3R_2(R_i - R_3\delta_{i3})}{R^5}\right) + 3\alpha\xi_3\left(\frac{R_3\delta_{i2} + R_2\delta_{i3}}{R^5} - \frac{5R_2R_3R_i}{R^7}\right)\right\}$$

Elements of displacement at (x_1, x_2, x_3) due to strain nuclei $\partial u^2/\partial \xi_2$ at (ξ_1, ξ_2, ξ_3) are as follows.

$$\frac{\partial u_{i\,A}^2}{\partial \xi_2} = \frac{F}{8\pi\mu}\left\{(2-\alpha)\frac{R_2}{R^3}\delta_{i2} - \alpha\frac{R_i + R_2\delta_{i2}}{R^3} + 3\alpha\frac{{R_2}^2R_i}{R^5}\right\}$$

$$\frac{\partial u_{i\,B}^2}{\partial \xi_2} = \frac{F}{4\pi\mu}\left\{-\frac{R_i}{R^3} + \frac{3{R_2}^2R_i}{R^5}\right.$$
$$\left. + \frac{1-\alpha}{\alpha}\left[\frac{R_2\delta_{i2}}{R(R+R_3)^2} + \left(\frac{1}{R(R+R_3)} - \frac{{R_2}^2(2R+R_3)}{R^3(R+R_3)^2}\right)\delta_{i3} + \left(\frac{R_i + R_2\delta_{i2}}{R(R+R_3)^2} - \frac{{R_2}^2R_i(3R+R_3)}{R^3(R+R_3)^3}\right)(1-\delta_{i3})\right]\right\}$$

$$\frac{\partial u_{i\,C}^2}{\partial \xi_2} = \frac{F}{4\pi\mu}(1-2\delta_{i3})\left\{(2-\alpha)\left(\frac{1}{R^3} - \frac{3{R_2}^2}{R^5}\right)\delta_{i3} + 3\alpha\xi_3\left(\frac{R_i + 2R_2\delta_{i2}}{R^5} - \frac{5{R_2}^2R_i}{R^7}\right)\right\}$$

Elements of displacement at (x_1, x_2, x_3) due to strain nuclei $\partial u^3/\partial \xi_3$ at (ξ_1, ξ_2, ξ_3) are as follows.

$$\frac{\partial u_{i\,A}^3}{\partial \xi_3} = \frac{F}{8\pi\mu}\left\{(2-\alpha)\frac{R_3}{R^3}\delta_{i3} - \alpha\frac{R_i + R_3\delta_{i3}}{R^3} + 3\alpha\frac{{R_3}^2R_i}{R^5}\right\}$$

$$\frac{\partial u_{i\,B}^3}{\partial \xi_3} = \frac{F}{4\pi\mu}\left\{-\frac{R_i}{R^3} + \frac{3{R_3}^2R_i}{R^5} + \frac{1-\alpha}{\alpha}\frac{R_i}{R^3}\right\}$$

$$\frac{\partial u_{i\,C}^3}{\partial \xi_3} = \frac{F}{4\pi\mu}(1-2\delta_{i3})\left\{(2-\alpha)\frac{3R_3(R_i - R_3\delta_{i3})}{R^5} + \alpha\left(\frac{\delta_{i3}}{R^3} - \frac{3R_3R_i}{R^5}\right) + 3\alpha\xi_3\left(\frac{R_i + 2R_3\delta_{i3}}{R^5} - \frac{5{R_3}^2R_i}{R^7}\right)\right\}$$

where, $R_1 = x_1 - \xi_1,\ R_2 = x_2 - \xi_2,\ R_3 = -x_3 - \xi_3$ and $R^2 = R_1^2 + R_2^2 + R_3^2$

When source is located at $(0, 0, -c)$, $\xi_1 = 0,\ \xi_2 = 0,\ \xi_3 = -c$
So, $R_1 = x_1,\ R_2 = x_2,\ R_3 = c - x_3$

Here, if we use coordinate system (x, y, z) instead of (x_1, x_2, x_3), $R_1 = x,\ R_2 = y,\ R_3 = c - z = d$
Then, the above displacement elements are written as follows

Elements of displacement at (x, y, z) due to strain nuclei $\partial u^2/\partial \xi_3$ at $(0, 0, -c)$ are

$$\frac{\partial u_{i\,A}^2}{\partial \xi_3} = \frac{F}{8\pi\mu}\left\{(2-\alpha)\frac{d}{R^3}\delta_{i2} - \alpha\frac{y}{R^3}\delta_{i3} + \alpha\frac{3ydR_i}{R^5}\right\}$$

$$\frac{\partial u_{i\,B}^2}{\partial \xi_3} = \frac{F}{4\pi\mu}\left\{\frac{d\delta_{i2} - y\delta_{i3}}{R^3} + \frac{3ydR_i}{R^5} + \frac{1-\alpha}{\alpha}\left[\frac{\delta_{i2}}{R(R+d)} - \frac{y}{R^3}\delta_{i3} - \frac{yR_i(2R+d)}{R^3(R+d)^2}(1-\delta_{i3})\right]\right\}$$

$$\frac{\partial u_{i\,C}^2}{\partial \xi_3} = \frac{F}{4\pi\mu}(1-2\delta_{i3})\left\{-(2-\alpha)\frac{3yd}{R^5}\delta_{i3} + \alpha\left(\frac{\delta_{i2}}{R^3} - \frac{3yR_i}{R^5}\right) - 3c\alpha\left(\frac{d\delta_{i2} + y\delta_{i3}}{R^5} - \frac{5ydR_i}{R^7}\right)\right\}$$

Elements of displacement at (x,y,z) due to strain nuclei $\partial u^3/\partial\xi_2$ at $(0,0,-c)$ are

$$\frac{\partial u^3_{i\,A}}{\partial\xi_2}=\frac{F}{8\pi\mu}\left\{(2-\alpha)\frac{y}{R^3}\delta_{i3}-\alpha\frac{d}{R^3}\delta_{i2}+\alpha\frac{3ydR_i}{R^5}\right\}$$

$$\frac{\partial u^3_{i\,B}}{\partial\xi_2}=\frac{F}{4\pi\mu}\left\{\frac{y\delta_{i3}-d\delta_{i2}}{R^3}+\frac{3ydR_i}{R^5}+\frac{1-\alpha}{\alpha}\left[\frac{y\delta_{i3}}{R(R+d)^2}-\frac{\delta_{i2}}{R(R+d)}+\frac{yR_i(2R+d)}{R^3(R+d)^2}\right]\right\}$$

$$\frac{\partial u^3_{i\,C}}{\partial\xi_2}=\frac{F}{4\pi\mu}(1-2\delta_{i3})\left\{(2-\alpha)\left(-\frac{\delta_{i2}}{R^3}+\frac{3y(R_i-d\delta_{i3})}{R^5}\right)-3c\alpha\left(\frac{d\delta_{i2}+y\delta_{i3}}{R^5}-\frac{5ydR_i}{R^7}\right)\right\}$$

Elements of displacement at (x,y,z) due to strain nuclei $\partial u^2/\partial\xi_2$ at $(0,0,-c)$ are

$$\frac{\partial u^2_{i\,A}}{\partial\xi_2}=\frac{F}{8\pi\mu}\left\{(2-\alpha)\frac{y}{R^3}\delta_{i2}-\alpha\frac{R_i+y\delta_{i2}}{R^3}+\alpha\frac{3y^2R_i}{R^5}\right\}$$

$$\frac{\partial u^2_{i\,B}}{\partial\xi_2}=\frac{F}{4\pi\mu}\left\{-\frac{R_i}{R^3}+\frac{3y^2R_i}{R^5}+\frac{1-\alpha}{\alpha}\left[\frac{y\delta_{i2}}{R(R+d)^2}+\left(\frac{1}{R(R+d)}-\frac{y^2(2R+d)}{R^3(R+d)^2}\right)\delta_{i3}+\left(\frac{R_i+y\delta_{i2}}{R(R+d)^2}-\frac{y^2R_i(3R+d)}{R^3(R+d)^3}\right)(1-\delta_{i3})\right]\right\}$$

$$\frac{\partial u^2_{i\,C}}{\partial\xi_2}=\frac{F}{4\pi\mu}(1-2\delta_{i3})\left\{(2-\alpha)\left(\frac{1}{R^3}-\frac{3y^2}{R^5}\right)\delta_{i3}-3c\alpha\left(\frac{R_i+2y\delta_{i2}}{R^5}-\frac{5y^2R_i}{R^7}\right)\right\}$$

Elements of displacement at (x,y,z) due to strain nuclei $\partial u^3/\partial\xi_3$ at $(0,0,-c)$ are

$$\frac{\partial u^3_{i\,A}}{\partial\xi_3}=\frac{F}{8\pi\mu}\left\{(2-\alpha)\frac{d}{R^3}\delta_{i3}-\alpha\frac{R_i+d\delta_{i3}}{R^3}+\alpha\frac{3d^2R_i}{R^5}\right\}$$

$$\frac{\partial u^3_{i\,B}}{\partial\xi_3}=\frac{F}{4\pi\mu}\left\{-\frac{R_i}{R^3}+\frac{3d^2R_i}{R^5}+\frac{1-\alpha}{\alpha}\frac{R_i}{R^3}\right\}$$

$$\frac{\partial u^3_{i\,C}}{\partial\xi_3}=\frac{F}{4\pi\mu}(1-2\delta_{i3})\left\{(2-\alpha)\frac{3d(R_i-d\delta_{i3})}{R^5}+\alpha\left(\frac{\delta_{i3}}{R^3}-\frac{3dR_i}{R^5}\right)-3c\alpha\left(\frac{R_i+2d\delta_{i3}}{R^5}-\frac{5d^2R_i}{R^7}\right)\right\}$$

Combining these components,

$$u^{23+32}_{i\;A}\equiv\frac{\partial u^2_{i\,A}}{\partial\xi_3}+\frac{\partial u^3_{i\,A}}{\partial\xi_2}=\frac{F}{4\pi\mu}\left\{(1-\alpha)\frac{d\delta_{i2}+y\delta_{i3}}{R^3}+\alpha\frac{3ydR_i}{R^5}\right\}$$

$$u^{23+32}_{i\;B}\equiv\frac{\partial u^2_{i\,B}}{\partial\xi_3}+\frac{\partial u^3_{i\,B}}{\partial\xi_2}=\frac{F}{2\pi\mu}\left\{\frac{3ydR_i}{R^5}+\frac{1-\alpha}{2\alpha}y(R_i-d)\frac{2R+d}{R^3(R+d)^2}\delta_{i3}\right\}$$

$$u^{23+32}_{i\;C}\equiv\frac{\partial u^2_{i\,C}}{\partial\xi_3}+\frac{\partial u^3_{i\,C}}{\partial\xi_2}=\frac{F}{2\pi\mu}(1-2\delta_{i3})\left\{(1-\alpha)\left(-\frac{\delta_{i2}}{R^3}-\frac{3yR_i}{R^5}\right)-(2-\alpha)\frac{3yd}{R^5}\delta_{i3}-3c\alpha\left(\frac{d\delta_{i2}+y\delta_{i3}}{R^5}-\frac{5ydR_i}{R^7}\right)\right\}$$

$$u^{33-22}_{i\;A}\equiv\frac{\partial u^3_{i\,A}}{\partial\xi_3}-\frac{\partial u^2_{i\,A}}{\partial\xi_2}=\frac{F}{4\pi\mu}\left\{(1-\alpha)\frac{d\delta_{i3}-y\delta_{i2}}{R^3}-\alpha\frac{3(y^2-d^2)R_i}{2R^5}\right\}$$

$$u^{33-22}_{i\;B}\equiv\frac{\partial u^3_{i\,B}}{\partial\xi_3}-\frac{\partial u^2_{i\,B}}{\partial\xi_2}=\frac{F}{2\pi\mu}\left\{\frac{3(d^2-y^2)R_i}{2R^5}+\frac{1-\alpha}{2\alpha}\left[\frac{R_i}{R^3}-\frac{\delta_{i3}}{R(R+d)}-\frac{2y\delta_{i2}+R_i(1-\delta_{i3})}{R(R+d)^2}+\frac{y^2(2R+d)}{R^3(R+d)^2}\delta_{i3}+\frac{y^2R_i(3R+d)}{R^3(R+d)^3}(1-\delta_{i3})\right]\right\}$$

$$u^{33-22}_{i\;C}\equiv\frac{\partial u^3_{i\,C}}{\partial\xi_3}-\frac{\partial u^2_{i\,C}}{\partial\xi_2}=\frac{F(1-2\delta_{i3})}{2\pi\mu}\left\{(1-\alpha)\left(-\frac{\delta_{i3}}{R^3}+\frac{3dR_i}{R^5}\right)+(2-\alpha)\frac{3(y^2-d^2)}{2R^5}\delta_{i3}+3c\alpha\left[\frac{y\delta_{i2}-d\delta_{i3}}{R^5}-\frac{5(y^2-d^2)R_i}{2R^7}\right]\right\}$$

Namely, the elements of displacement at (x,y,z) due to a double couple (23+32) at $(0,0,-c)$ are as follows.

$$u^{23+32}_{i\;A}=\frac{F}{2\pi\mu}\begin{pmatrix}\frac{\alpha}{2}\frac{3xyd}{R^5}\\ \frac{1-\alpha}{2}\frac{d}{R^3}+\frac{\alpha}{2}\frac{3y^2d}{R^5}\\ \frac{1-\alpha}{2}\frac{y}{R^3}+\frac{\alpha}{2}\frac{3yd^2}{R^5}\end{pmatrix}\qquad u^{23+32}_{i\;B}=\frac{F}{2\pi\mu}\begin{pmatrix}\frac{3xyd}{R^5}\\ \frac{3y^2d}{R^5}\\ \frac{3yd^2}{R^5}\end{pmatrix}\qquad u^{23+32}_{i\;C}=\frac{F}{2\pi\mu}\begin{pmatrix}(1-\alpha)\frac{3xy}{R^5}+\alpha\frac{3cx}{R^5}\frac{5yd}{R^2}\\ -(1-\alpha)\frac{1}{R^3}B_3-\alpha\frac{3cd}{R^5}B_5\\ \frac{3yd}{R^5}+\alpha\frac{3cy}{R^5}C_5\end{pmatrix}$$

And the elements of displacement at (x, y, z) due to a couple (33-22) at $(0, 0, -c)$ are as follows.

$$u_i^{33-22}{}_A = \frac{F}{2\pi\mu}\begin{pmatrix} -\frac{\alpha}{2}\frac{3x(y^2-d^2)}{2R^5} \\ -\frac{1-\alpha}{2}\frac{y}{R^3}-\frac{\alpha}{2}\frac{3y(y^2-d^2)}{2R^5} \\ \frac{1-\alpha}{2}\frac{d}{R^3}-\frac{\alpha}{2}\frac{3d(y^2-d^2)}{2R^5} \end{pmatrix} \qquad u_i^{33-22}{}_B = \frac{F}{2\pi\mu}\begin{pmatrix} -\frac{3x(y^2-d^2)}{2R^5}+\frac{1-\alpha}{2\alpha}\left(\frac{x}{R^3}-I_2^0\right) \\ -\frac{3y(y^2-d^2)}{2R^5}+\frac{1-\alpha}{2\alpha}I_1^0 \\ -\frac{3d(y^2-d^2)}{2R^5}+\frac{1-\alpha}{2\alpha}I_5^0 \end{pmatrix}$$

$$u_i^{33-22}{}_C = \frac{F}{2\pi\mu}\begin{pmatrix} (1-\alpha)\frac{3xd}{R^5} & -3c\alpha\frac{5x(y^2-d^2)}{2R^7} \\ (1-\alpha)\frac{3yd}{R^5} & +3c\alpha\left(\frac{y}{R^5}-\frac{5y(y^2-d^2)}{2R^7}\right) \\ (1-\alpha)\frac{1}{R^3}C_3-(2-\alpha)\frac{3(y^2-d^2)}{2R^5} & +3c\alpha\left(\frac{d}{R^5}+\frac{5d(y^2-d^2)}{2R^7}\right) \end{pmatrix}$$

where, $B_3 = 1-\frac{3y^2}{R^2}$, $B_5 = 1-\frac{5y^2}{R^2}$, $C_3 = 1-\frac{3d^2}{R^2}$, $C_5 = 1-\frac{5d^2}{R^2}$ and

$$I_1^0 = y\left[\frac{1}{R(R+d)^2}-x^2\frac{3R+d}{R^3(R+d)^3}\right] \quad I_2^0 = x\left[\frac{1}{R(R+d)^2}-y^2\frac{3R+d}{R^3(R+d)^3}\right] \quad I_5^0 = \frac{1}{R(R+d)}-x^2\frac{2R+d}{R^3(R+d)^2}$$

Finally the displacement due to a point dip-slip with a moment *Mo* are given by eq.(5).

$$u^o = \frac{Mo}{F}\left[u^{23+32}\cos 2\delta + u^{33-22}\sin 2\delta\right]$$

So, their elements of displacement at (x, y, z) due to a point dip-slip at $(0, 0, -c)$ are as follows.

$$u_A^o = \frac{Mo}{2\pi\mu}\begin{pmatrix} -\frac{\alpha}{2}\frac{3xpq}{R^5} \\ -\frac{1-\alpha}{2}\frac{s}{R^3}-\frac{\alpha}{2}\frac{3ypq}{R^5} \\ \frac{1-\alpha}{2}\frac{t}{R^3}-\frac{\alpha}{2}\frac{3dpq}{R^5} \end{pmatrix} \qquad u_B^o = \frac{Mo}{2\pi\mu}\begin{pmatrix} -\frac{3xpq}{R^5}+\frac{1-\alpha}{\alpha}\left(\frac{x}{R^3}-I_2^0\right)\sin\delta\cos\delta \\ -\frac{3ypq}{R^5}+\frac{1-\alpha}{\alpha}I_1^0\sin\delta\cos\delta \\ -\frac{3dpq}{R^5}+\frac{1-\alpha}{\alpha}I_5^0\sin\delta\cos\delta \end{pmatrix}$$

$$u_C^o = \frac{Mo}{2\pi\mu}\begin{pmatrix} (1-\alpha)\frac{3xt}{R^5} & -\alpha\frac{15cxpq}{R^7} \\ (1-\alpha)\left(\frac{3yt}{R^5}-\frac{\cos 2\delta}{R^3}\right) & -\alpha\frac{15cypq}{R^7}+\alpha\frac{3cs}{R^5} \\ -(1-\alpha)\frac{A_3}{R^3}\sin\delta\cos\delta & +\alpha\frac{15cdpq}{R^7}+\alpha\frac{3ct}{R^5}-\frac{3pq}{R^5} \end{pmatrix}$$

where, $A_3 = 1-\frac{3x^2}{R^2}$, $d = c - z$, $\begin{cases} p = y\cos\delta + d\sin\delta \\ q = y\sin\delta - d\cos\delta \end{cases}$, $pq = \frac{y^2-d^2}{2}\sin 2\delta - yd\cos 2\delta$

$$\begin{cases} s = p\sin\delta + q\cos\delta = y\sin 2\delta - d\cos 2\delta \\ t = p\cos\delta - q\sin\delta = y\cos 2\delta + d\sin 2\delta \end{cases}, \quad R^2 = x^2+y^2+d^2 = x^2+p^2+q^2 = x^2+s^2+t^2$$

The above three vectors basically correspond to the contents of the row of Dip Slip in Table 2, although a slight modification was made in the following two points.

(1) The sign of u_A^o was converted, because this part is calculated by $u_A^o(x,y,z) - u_A^o(x,y,-z)$, different from its original definition in eq.(2), $u_A(x_1,x_2,-x_3) - u_A(x_1,x_2,x_3)$.

(2) Terms of *z*-components in u_B^o $\left(-\frac{3dpq}{R^5}\right)$ and u_C^o $\left(-\frac{3pq}{R^5}\right)$ were partially merged using the calculation rule of $u_B^o(x,y,z) + z u_C^o(x,y,z)$ to get the simpler expression.

Since $-\frac{3dpq}{R^5} - z\frac{3pq}{R^5} = -\frac{3cpq}{R^5}$, *3dpq* was changed to *3cpq* in the *z*-component of u_B^o, while the term $-\frac{3pq}{R^5}$ disappeared from the *z*-component of u_C^o.

(3) Tensile << Substitution of eq. (2) to eq. (6) >>

Elements of displacement at (x_1,x_2,x_3) due to strain nuclei $\partial u^1/\partial\xi_1$ at (ξ_1,ξ_2,ξ_3) are as follows.

$$\frac{\partial u^1_{i\,A}}{\partial\xi_1}=\frac{F}{8\pi\mu}\left\{(2-\alpha)\frac{R_1}{R^3}\delta_{i1}-\alpha\frac{R_i+R_1\delta_{i1}}{R^3}+3\alpha\frac{{R_1}^2R_i}{R^5}\right\}$$

$$\frac{\partial u^1_{i\,B}}{\partial\xi_1}=\frac{F}{4\pi\mu}\left\{-\frac{R_i}{R^3}+\frac{3{R_1}^2R_i}{R^5}\right.$$
$$\left.+\frac{1-\alpha}{\alpha}\left[\frac{R_1\delta_{i1}}{R(R+R_3)^2}+\left(\frac{1}{R(R+R_3)}-\frac{{R_1}^2(2R+R_3)}{R^3(R+R_3)^2}\right)\delta_{i3}+\left(\frac{R_i+R_1\delta_{i1}}{R(R+R_3)^2}-\frac{{R_1}^2R_i(3R+R_3)}{R^3(R+R_3)^3}\right)(1-\delta_{i3})\right]\right\}$$

$$\frac{\partial u^1_{i\,C}}{\partial\xi_1}=\frac{F}{4\pi\mu}(1-2\delta_{i3})\left\{(2-\alpha)\left(\frac{1}{R^3}-\frac{3{R_1}^2}{R^5}\right)\delta_{i3}+3\alpha\xi_3\left(\frac{R_i+2R_1\delta_{i1}}{R^5}-\frac{5{R_1}^2R_i}{R^7}\right)\right\}$$

where, $R_1=x_1-\xi_1,\ R_2=x_2-\xi_2,\ R_3=-x_3-\xi_3$ and $R^2=R_1^2+R_2^2+R_3^2$

When source is located at $(0,0,-c)$, $\xi_1=0,\ \xi_2=0,\ \xi_3=-c$
So, $R_1=x_1,\ R_2=x_2,\ R_3=c-x_3$

Here, if we use coordinate system (x,y,z) instead of (x_1,x_2,x_3), $R_1=x,\ R_2=y,\ R_3=c-z=d$
Then, the above displacement elements are written as follows

Elements of displacement at (x,y,z) due to strain nuclei $\partial u^1/\partial\xi_1$ at $(0,0,-c)$ are

$$\frac{\partial u^1_{i\,A}}{\partial\xi_1}=\frac{F}{8\pi\mu}\left\{(2-\alpha)\frac{x}{R^3}\delta_{i1}-\alpha\frac{R_i+x\delta_{i1}}{R^3}+\alpha\frac{3x^2R_i}{R^5}\right\}$$

$$\frac{\partial u^1_{i\,B}}{\partial\xi_1}=\frac{F}{4\pi\mu}\left\{-\frac{R_i}{R^3}+\frac{3x^2R_i}{R^5}+\frac{1-\alpha}{\alpha}\left[\frac{x\delta_{i1}}{R(R+d)^2}+\left(\frac{1}{R(R+d)}-\frac{x^2(2R+d)}{R^3(R+d)^2}\right)\delta_{i3}+\left(\frac{R_i+x\delta_{i1}}{R(R+d)^2}-\frac{x^2R_i(3R+d)}{R^3(R+d)^3}\right)(1-\delta_{i3})\right]\right\}$$

$$\frac{\partial u^1_{i\,C}}{\partial\xi_1}=\frac{F}{4\pi\mu}(1-2\delta_{i3})\left\{(2-\alpha)\left(\frac{1}{R^3}-\frac{3x^2}{R^5}\right)\delta_{i3}-3c\alpha\left(\frac{R_i+2x\delta_{i1}}{R^5}-\frac{5x^2R_i}{R^7}\right)\right\}$$

Combining the components so far appeared,

$$u^{nn}_{i\ A}\equiv\frac{\partial u^1_{i\,A}}{\partial\xi_1}+\frac{\partial u^2_{i\,A}}{\partial\xi_2}+\frac{\partial u^3_{i\,A}}{\partial\xi_3}=\frac{F}{4\pi\mu}(1-\alpha)\frac{x\delta_{i1}+y\delta_{i2}+d\delta_{i3}}{R^3}$$

$$u^{nn}_{i\ B}\equiv\frac{\partial u^1_{i\,B}}{\partial\xi_1}+\frac{\partial u^2_{i\,B}}{\partial\xi_2}+\frac{\partial u^3_{i\,B}}{\partial\xi_3}=\frac{F}{2\pi\mu}\frac{1-\alpha}{\alpha}\left\{\frac{R_i}{R^3}+\frac{x\delta_{i1}+y\delta_{i2}-R_i(1-\delta_{i3})}{R(R+d)^2}+\frac{d-R_i}{2R^3}\delta_{i3}\right\}$$

$$u^{nn}_{i\ C}\equiv\frac{\partial u^1_{i\,C}}{\partial\xi_1}+\frac{\partial u^2_{i\,C}}{\partial\xi_2}+\frac{\partial u^3_{i\,C}}{\partial\xi_3}=\frac{F}{2\pi\mu}(1-2\delta_{i3})\left\{-(1-\alpha)\left(\frac{\delta_{i3}}{R^3}-\frac{3dR_i}{R^5}\right)-3c\alpha\frac{x\delta_{i1}+y\delta_{i2}+d\delta_{i3}-R_i}{R^5}\right\}$$

$$u^{2s3c}_{i\ A}\equiv\frac{\partial u^2_{i\,A}}{\partial\xi_2}sin^2\delta+\frac{\partial u^3_{i\,A}}{\partial\xi_3}cos^2\delta=\frac{F}{4\pi\mu}\left\{(1-\alpha)\frac{y\delta_{i2}sin^2\delta+d\delta_{i3}cos^2\delta}{R^3}-\frac{\alpha}{2}\frac{R_i}{R^3}+\frac{\alpha}{2}\frac{3R_i}{R^5}(y^2sin^2\delta+d^2cos^2\delta)\right\}$$

$$u^{2s3c}_{i\ B}\equiv\frac{\partial u^2_{i\,B}}{\partial\xi_2}sin^2\delta+\frac{\partial u^3_{i\,B}}{\partial\xi_3}cos^2\delta=\frac{F}{4\pi\mu}\left\{-\frac{R_i}{R^3}+\frac{3R_i}{R^5}(y^2sin^2\delta+d^2cos^2\delta)\right.$$
$$\left.+\frac{1-\alpha}{\alpha}\left[\frac{R_i}{R^3}cos^2\delta+\frac{y\delta_{i2}}{R(R+d)^2}sin^2\delta+\left(\frac{1}{R(R+d)}-\frac{y^2(2R+d)}{R^3(R+d)^2}\right)\delta_{i3}sin^2\delta+\left(\frac{R_i+y\delta_{i2}}{R(R+d)^2}-\frac{y^2R_i(3R+d)}{R^3(R+d)^3}\right)(1-\delta_{i3})sin^2\delta\right]\right\}$$

$$u^{2s3c}_{i\ C}\equiv\frac{\partial u^2_{i\,C}}{\partial\xi_2}sin^2\delta+\frac{\partial u^3_{i\,C}}{\partial\xi_3}cos^2\delta=\frac{F(1-2\delta_{i3})}{4\pi\mu}\left\{(2-\alpha)\left[\left(\frac{1}{R^3}-\frac{3y^2}{R^5}\right)\delta_{i3}sin^2\delta+\frac{3d(R_i-d\delta_{i3})}{R^5}cos^2\delta\right]\right.$$
$$\left.+\alpha\left(\frac{\delta_{i3}}{R^3}-\frac{3dR_i}{R^5}\right)cos^2\delta-3c\alpha\left[\frac{R_i}{R^5}+\frac{2(y\delta_{i2}sin^2\delta+d\delta_{i3}cos^2\delta)}{R^5}-\frac{5R_i}{R^7}(y^2sin^2\delta+d^2cos^2\delta)\right]\right\}$$

Namely, the elements of displacement at (x,y,z) due to a center of dilatation (nn) at $(0,0,-c)$ are as follows.

$$u^{nn}_{i\ A}=\frac{F}{2\pi\mu}\begin{pmatrix}\frac{1-\alpha}{2}\frac{x}{R^3}\\ \frac{1-\alpha}{2}\frac{y}{R^3}\\ \frac{1-\alpha}{2}\frac{d}{R^3}\end{pmatrix}\qquad u^{nn}_{i\ B}=\frac{F}{2\pi\mu}\begin{pmatrix}\frac{1-\alpha}{\alpha}\frac{x}{R^3}\\ \frac{1-\alpha}{\alpha}\frac{y}{R^3}\\ \frac{1-\alpha}{\alpha}\frac{d}{R^3}\end{pmatrix}\qquad u^{nn}_{i\ C}=\frac{F}{2\pi\mu}\begin{pmatrix}(1-\alpha)\frac{3xd}{R^5}\\ (1-\alpha)\frac{3yd}{R^5}\\ (1-\alpha)\frac{C_3}{R^3}\end{pmatrix}$$

The elements of displacement at (x, y, z) due to a couple (2s3c) at $(0, 0, -c)$ are as follows.

$$u_i^{2s3c}{}_A = \frac{F}{4\pi\mu}\begin{pmatrix} -\frac{\alpha}{2}\frac{x}{R^3} + \frac{\alpha}{2}\frac{3x}{R^5}(y^2\sin^2\delta + d^2\cos^2\delta) \\ (1-\alpha)\frac{y}{R^3}\sin^2\delta - \frac{\alpha}{2}\frac{y}{R^3} + \frac{\alpha}{2}\frac{3y}{R^5}(y^2\sin^2\delta + d^2\cos^2\delta) \\ (1-\alpha)\frac{d}{R^3}\cos^2\delta - \frac{\alpha}{2}\frac{d}{R^3} + \frac{\alpha}{2}\frac{3d}{R^5}(y^2\sin^2\delta + d^2\cos^2\delta) \end{pmatrix}$$

$$u_i^{2s3c}{}_B = \frac{F}{4\pi\mu}\begin{pmatrix} -\frac{x}{R^3} + \frac{3x}{R^5}(y^2\sin^2\delta + d^2\cos^2\delta) + \frac{1-\alpha}{\alpha}\left\{\frac{x}{R^3} - \left(\frac{x}{R^3} - I_2^0\right)\sin^2\delta\right\} \\ -\frac{y}{R^3} + \frac{3y}{R^5}(y^2\sin^2\delta + d^2\cos^2\delta) + \frac{1-\alpha}{\alpha}\left\{\frac{y}{R^3} - I_1^0\sin^2\delta\right\} \\ -\frac{d}{R^3} + \frac{3d}{R^5}(y^2\sin^2\delta + d^2\cos^2\delta) + \frac{1-\alpha}{\alpha}\left\{\frac{d}{R^3} - I_5^0\sin^2\delta\right\} \end{pmatrix}$$

$$u_i^{2s3c}{}_C = \frac{F}{4\pi\mu}\begin{pmatrix} 2(1-\alpha)\frac{3xd}{R^5}\cos^2\delta - 3c\alpha\left[\frac{x}{R^5} - \frac{5x}{R^7}(y^2\sin^2\delta + d^2\cos^2\delta)\right] \\ 2(1-\alpha)\frac{3yd}{R^5}\cos^2\delta - 3c\alpha\left[\frac{y}{R^5}(1+2\sin^2\delta) - \frac{5y}{R^7}(y^2\sin^2\delta + d^2\cos^2\delta)\right] \\ -(2-\alpha)\frac{B_3}{R^3}\sin^2\delta - \alpha\frac{C_3}{R^3}\cos^2\delta + 3c\alpha\left[\frac{d}{R^5}(1+2\cos^2\delta) - \frac{5d}{R^7}(y^2\sin^2\delta + d^2\cos^2\delta)\right] \end{pmatrix}$$

As before, the elements of displacement at (x, y, z) due to a double couple (23+32) at $(0, 0, -c)$ are.

$$u_i^{23+32}{}_A = \frac{F}{2\pi\mu}\begin{pmatrix} \frac{\alpha}{2}\frac{3xyd}{R^5} \\ \frac{1-\alpha}{2}\frac{d}{R^3} + \frac{\alpha}{2}\frac{3y^2d}{R^5} \\ \frac{1-\alpha}{2}\frac{y}{R^3} + \frac{\alpha}{2}\frac{3yd^2}{R^5} \end{pmatrix} \qquad u_i^{23+32}{}_B = \frac{F}{2\pi\mu}\begin{pmatrix} \frac{3xyd}{R^5} \\ \frac{3y^2d}{R^5} \\ \frac{3yd^2}{R^5} \end{pmatrix} \qquad u_i^{23+32}{}_C = \frac{F}{2\pi\mu}\begin{pmatrix} (1-\alpha)\frac{3xy}{R^5} + \alpha\frac{3cd}{R^5}\frac{5xy}{R^2} \\ -(1-\alpha)\frac{1}{R^3}B_3 - \alpha\frac{3cd}{R^5}B_5 \\ \frac{3yd}{R^5} + \alpha\frac{3cy}{R^5}C_5 \end{pmatrix}$$

where, $B_3 = 1 - \frac{3y^2}{R^2}$, $B_5 = 1 - \frac{5y^2}{R^2}$, $C_3 = 1 - \frac{3d^2}{R^2}$, $C_5 = 1 - \frac{5d^2}{R^2}$ and

$$I_1^0 = y\left[\frac{1}{R(R+d)^2} - x^2\frac{3R+d}{R^3(R+d)^3}\right] \qquad I_2^0 = x\left[\frac{1}{R(R+d)^2} - y^2\frac{3R+d}{R^3(R+d)^3}\right] \qquad I_5^0 = \frac{1}{R(R+d)} - x^2\frac{2R+d}{R^3(R+d)^2}$$

Finally the displacement due to a point tensile fault with a moment *Mo* are given by eq.(6).

$$u^o = \frac{Mo}{F}\left[\frac{2\alpha-1}{1-\alpha}u^{nn} + 2u^{2s3c} - u^{23+32}\sin 2\delta\right]$$

So, their elements of displacement at (x, y, z) due to a point tensile fault at $(0, 0, -c)$ are as follows.

$$u_A^o = \frac{Mo}{2\pi\mu}\begin{pmatrix} -\frac{1-\alpha}{2}\frac{x}{R^3} + \frac{\alpha}{2}\frac{3xq^2}{R^5} \\ -\frac{1-\alpha}{2}\frac{t}{R^3} + \frac{\alpha}{2}\frac{3yq^2}{R^5} \\ -\frac{1-\alpha}{2}\frac{s}{R^3} + \frac{\alpha}{2}\frac{3dq^2}{R^5} \end{pmatrix} \qquad u_B^o = \frac{Mo}{2\pi\mu}\begin{pmatrix} \frac{3xq^2}{R^5} - \frac{1-\alpha}{\alpha}\left(\frac{x}{R^3} - I_2^0\right)\sin^2\delta \\ \frac{3yq^2}{R^5} - \frac{1-\alpha}{\alpha}I_1^0\sin^2\delta \\ \frac{3dq^2}{R^5} - \frac{1-\alpha}{\alpha}I_5^0\sin^2\delta \end{pmatrix}$$

$$u_C^o = \frac{Mo}{2\pi\mu}\begin{pmatrix} -(1-\alpha)\frac{3xs}{R^5} + \alpha\frac{15cxq^2}{R^7} - \alpha\frac{3xz}{R^5} \\ (1-\alpha)\left(\frac{\sin 2\delta}{R^3} - \frac{3ys}{R^5}\right) + 3c\alpha\frac{t-y}{R^5} + \alpha\frac{15cyq^2}{R^7} - \alpha\frac{3yz}{R^5} \\ -(1-\alpha)\left(\frac{\cos^2\delta}{R^3} + \frac{3x^2}{R^5}\sin^2\delta\right) - 3c\alpha\frac{s-d}{R^5} - \alpha\frac{15cdq^2}{R^7} + \alpha\frac{3dz}{R^5} + \frac{3q^2}{R^5} \end{pmatrix}$$

where, $A_3 = 1 - \frac{3x^2}{R^2}$, $d = c - z$, $\begin{cases} p = y\cos\delta + d\sin\delta \\ q = y\sin\delta - d\cos\delta \end{cases}$, $pq = \frac{y^2-d^2}{2}\sin 2\delta - yd\cos 2\delta$

$$\begin{cases} s = p\sin\delta + q\cos\delta = y\sin 2\delta - d\cos 2\delta \\ t = p\cos\delta - q\sin\delta = y\cos 2\delta + d\sin 2\delta \end{cases}, \quad R^2 = x^2 + y^2 + d^2 = x^2 + p^2 + q^2 = x^2 + s^2 + t^2$$

The above three vectors basically correspond to the contents of the row of Tensile in Table 2, although a slight modification was made in the following two points.

(1) The sign of u_A^o was converted, because this part is calculated by $u_A^o(x,y,z) - u_A^o(x,y,-z)$, different from its original definition in eq.(2), $u_A(x_1,x_2,-x_3) - u_A(x_1,x_2,x_3)$.

(2) Terms of z-components in u_B^o $\left(\frac{3dq^2}{R^5}\right)$ and u_C^o $\left(\frac{3q^2}{R^5}\right)$ were partially merged using the calculation rule of $u_B^o(x,y,z) + zu_C^o(x,y,z)$ to get the simpler expression.

Since $\frac{3dq^2}{R^5} + z\frac{3q^2}{R^5} = \frac{3cq^2}{R^5}$, $3dq^2$ was changed to $3cq^2$ in the z-component of u_B^o , while the term $\frac{3q^2}{R^5}$ disappeared from the z-component of u_C^o .

(4) Inflation

The elements of displacement at (x,y,z) due to a center of dilatation at $(0,0,-c)$ are already obtained.

$$u^o = \frac{Mo}{F}u^{nn}$$

$$u_A^o = \frac{Mo}{2\pi\mu}\begin{pmatrix} \frac{1-\alpha}{2}\frac{x}{R^3} \\ \frac{1-\alpha}{2}\frac{y}{R^3} \\ \frac{1-\alpha}{2}\frac{d}{R^3} \end{pmatrix} \qquad u_B^o = \frac{Mo}{2\pi\mu}\begin{pmatrix} \frac{1-\alpha}{\alpha}\frac{x}{R^3} \\ \frac{1-\alpha}{\alpha}\frac{y}{R^3} \\ \frac{1-\alpha}{\alpha}\frac{d}{R^3} \end{pmatrix} \qquad u_C^o = \frac{Mo}{2\pi\mu}\begin{pmatrix} (1-\alpha)\frac{3xd}{R^5} \\ (1-\alpha)\frac{3yd}{R^5} \\ (1-\alpha)\frac{C_3}{R^3} \end{pmatrix}$$

The above three vectors basically correspond to the contents of the row of Inflation in Table 2, although a slight modification was made in the following point.

(1) The sign of u_A^o was converted, because this part is calculated by $u_A^o(x,y,z) - u_A^o(x,y,-z)$, different from its original definition in eq.(2), $u_A(x_1,x_2,-x_3) - u_A(x_1,x_2,x_3)$.